

Health Selectivity and SES-Health Gradients in Mexico-U.S. Migration and Return:  
A Bi-national Perspective on Older Adults

INTRODUCTION

Foreign-born Mexicans tend to have better health outcomes and mortality than the general U.S. population.<sup>1</sup> This health advantage of the Mexican immigrant population does not manifest itself in just a handful of health indicators, but in a broad spectrum of conditions that we can measure objectively, including infant and child mortality, older adult mortality and birthweight (Abraido-Lanza et al. 1999; Markides and Coreil 1986; Markides and Eschbach 2005; Stern and Wei 1999).<sup>2</sup> Yet despite their average relative good health, Mexican immigrants also tend to systematically manifest and report worse health the longer they stay in the U.S. (Cho, Frisbie and Rogers 2004)), oftentimes converging to and undershooting native-born levels.<sup>3</sup> The gradual worsening of the health conditions of foreign-born members of an ethnic group as duration in the U.S. increases and the subsequent loss of the ethnic health advantage for the second generation has been labeled ‘negative acculturation’ (Cho et al. 2004). Although worsening of health status reports could be due to the gradual adjustment of benchmarks for judging one’s health as acculturation itself takes place (Finch et al. 2002), this seems to be more than an artifact produced by cultural idiosyncrasies as similar deterioration manifest itself in more objectively measured health outcomes (Ceballos and Palloni 2007).

---

<sup>1</sup> For the general case of the foreign-born in the U.S., Canada, and Germany respectively, see Argesanau (2007), McDonald and Kennedy (2004), and Razum and Twardella (2002).

<sup>2</sup> Given that social class has a strong and positive relationship with health in the general population (Adler et al. 1994), researchers have coined the term Hispanic Health Paradox (HHP) in account of Hispanics’ superior health outcomes despite their socioeconomic disadvantages relative to non-Hispanic Whites in the United States (Palloni and Morenoff 2001).

<sup>3</sup> For the general case of the foreign-born in the U.S., Canada, and Germany respectively, see Antecol and Bedard (2006), McDonald and Kennedy (2005), and Razum and Twardella (2002).

These two issues, i.e. the immigrant health advantage and the negative duration-dependence of their health outcomes, are studied somewhat separately in the literature, despite the fact that they are intimately related at a minimum by virtue of being potential outcomes of similar artifacts (for an exception re a review of explanations, see Jasso et al. 2004). For instance, selective return migration of the unhealthy should always exaggerate the observed health conditions of an immigrant cohort and, *pari passu*, attenuate the apparent effects of acculturation if these are indeed negative but exaggerate them if they are positive. By the same token, heavy selection of healthy immigrants at the outset will produce the impression that immigrants are healthier on average than other subgroups, and should lead to an under-expression of the negative acculturation effect if acculturation is itself a result of better health status.

Recent findings suggest other peculiar results that could also implicate artifacts generated by selection processes. It has been shown that the socioeconomic gradient of health is flatter for Mexican migrants when compared to U.S.-born non-Hispanic Whites (Dowd and Goldman 2006; Turra and Goldman 2007). While this could be a result of a number of factors, including the unlikely one that SES gradients are flatter in Mexico to begin with, it is also possible that the health selection of immigrants could vary systematically by SES and, in particular, be stronger among individuals with low SES than among those with higher SES. Differential selection of this sort will necessarily attenuate underlying disparities (see Smith and Goldman, 2007).<sup>4</sup>

Most large studies that produce empirical facts about the health of the Mexican (and other Hispanic) immigrant population are based with data about people living in the US only. Ignoring the origin population causes three problems. First, one cannot assess the degree to which there is indeed selection among immigrants at the outset and whether or not the degree of selection

---

<sup>4</sup> These results could also be reflecting the importance of social inequality in access to proper diagnosis (Jurkowski and Johnson 2005). We will leave this issue aside from our discussion for the time being, but will come back to it later in the paper.

varies by subgroup of migrants. Second, we remain blindsided about the conditions of migrants who return and thus increase the chance of misinterpreting the nature of health processes among those who remain. Third, we neglect the nature of health determinants within the population that spawn migration and return, remaining ignorant about the nature of initial disparities among them.

In this paper, we compare health outcomes between the Mexican population living in Mexico, a subset of which is composed of return migrants from the US, and Mexican born migrants living in the US for varying periods of time. Our main focus is on self-reported conditions, including measures of obesity, hypertension, diabetes, and cardiovascular disease.<sup>5</sup> However, we bolster the analysis by examining a handful of biomarkers assessed both in the populations living in the US and in Mexico, and examine patterns of mortality both among Mexican immigrants in the US and among Mexicans living in Mexico. We also evaluate the SES gradient of these conditions and compare them across the two subpopulations. Because we use comparable nationally-representative surveys in Mexico and in the U.S., our analyses will be shielded somewhat from problems that weaken studies based on samples on only one side of the border. These comparisons provide evidence for the degree and direction of selection in the U.S.-bound and in the Mexico-bound return migrant population. In addition, we compare the SES-health gradient among Mexicans living in the US and those living in Mexico and thus shed light on whether or not migration selection may vary according to individuals' SES.

Understanding whether the health advantage of immigrants and its apparent erosion with increased duration in the U.S. are real phenomena or statistical artifacts and the actual role of SES is important for understanding the health conditions and possible health trajectories of an

---

<sup>5</sup> Diabetes and heart disease are the two major causes of adult death in Mexico (the latter two, the major causes of adult mortality in Mexico, see Población 2007)

increasingly numerous population on both sides of the border (i.e. immigrants in the U.S. and former U.S. migrants in Mexico). On the US side, the continuous flow of illegal migrants has increased the ranks of those who have little if any access to health care and services, a condition that should play against the persistence of any initial health advantage. On the Mexico side of the border, the return migrants may face a similar set of conditions as their absence from the Mexican labor markets makes them ineligible for a number of assistance and health state-sponsored programs. This can only worsen any health status disadvantage that return migrants may experience at the outset.

## PREVIOUS RESEARCH

In what follows we briefly summarize what is known about the three problems we study in this paper: the Hispanic paradox, negative acculturation and the contrast between SES gradients among receiving, migrant and origin populations.

### *The Hispanic Paradox or the Hispanic Health Advantage*

There are three broad categories of explanations for the so-called Hispanic Health Paradox (for a review of explanations, see Palloni and Morenoff 2001): data artifacts, immigrant selection, and the salmon bias (though a type of artifact itself, we shall consider it separately). First, *data artifacts* in the context of the paradox refer to *differential* measurement error of different kinds between Hispanics and, generally, Non-Hispanic Whites. These errors may affect a number of dimensions including age and national origins, coverage of deaths in vital statistics (Patel et al. 2004), coverage of populations in censuses or surveys, and differences in proper diagnosis for chronic conditions (Jurkowski and Johnson 2005).

Second, immigrant selection refers to processes whereby health itself or unmeasured characteristics related to health predispose (inhibit) individuals to migrate into the US so that a random sample of immigrants turns out to be healthier (unhealthier) than a random sample of the population of origin (Stern and Wei 1999). The vast majority of studies dealing with this topic fail to directly compare the health conditions of immigrants with those of their non-migrant counterparts in sending areas and thus neglect the matter of selection. As Jasso et al. (2004) point out, the fact that immigrants have better health outcomes than Non-Hispanic Whites suggests their health conditions are better than those of the people they left behind since, on average, health conditions tend to be better in the U.S. than in most immigrant origins, including Mexico. While knowing that selective immigration could be occurring is an advance, it is by no means enough. What one needs is a more precise comparison of the health conditions of migrants (preferably at the time migration takes place) with those who remain in the place of origin. It is only this type of contrasts that will enable us to gauge the magnitude and direction of the immigrant selection effect.

Third, and finally, the weak version of the “salmon bias” hypothesis posits that Mexican migrants returning to Mexico tend to be in worse health conditions than those who stay in the U.S. A strong version of the hypothesis is that return migration occurs because of bad or deteriorating health status. In either the weak or strong version, the implication is that the observed health status of the remaining immigrants in the U.S. will be better than if one observed the original migrant cohort. Compelling yet indirect evidence of the salmon bias for Mexicans (based on U.S. data) was found by Palloni and Arias (2004).

### *Negative Acculturation*

Explanations for the negative duration-dependence of health among migrants are less contested (Abraido-Lanza, Chao and Florez 2005; Cho et al. 2004; Morales et al. 2002). Scholars generally agree that increasing acculturation to the U.S. mainstream, a characteristic highly correlated with duration in the U.S., leads to a broad spectrum of exposure-related and behavioral changes that have negative effects on health conditions.(e.g. in diet, see Dixon, Sundquist and Winkleby 2000). While these results have been generally verified with cross-sectional data and are thus affected by the inability to separate migration cohort and proper duration effects, the health advantage of the foreign-born ‘erodes’ for their offspring, at least by the time they become adults (e.g. Barcenas et al. 2007). This finding strongly suggests that the phenomenon may not be fully or even partially explained solely by cohort (migration) effects. An important issue that we will be able to address is the extent to which the acculturation effect is being underplayed or exaggerated by return migration of the unhealthy. If the latter occurs mostly among short duration migrants, the observed data will exaggerate the effects of negative acculturation. The reverse occurs if return migrants are biased toward those with higher duration in the US.

### *The Role of Socioeconomic Status Revisited*

Goldman et al. (2006) used various data sources, including the National Health Interview Survey (NHIS), to show that the SES health gradient (typically measured in terms of years of educational attainment) for foreign-born Mexicans is flatter than that found for Non-Hispanic Whites across various self-reported conditions (for similar results for Hispanics with measured BMI and blood pressure respectively, see Khan, Sobal and Martorell 1997; Steffen 2006). Goldman *et al.* put forth three potential explanations for these trends. First, health selection might be stronger for immigrants of lower SES. Second, SES gradients could be steeper in the

U.S. than in Mexico (at least in rural areas, see Smith and Goldman 2007). And third, Mexicans of lower SES might report better health than ‘expected’ due to their lack of access to health care and thus proper diagnosis of many chronic conditions (Jurkowski and Johnson 2005). Turra and Goldman (2007) found similar results for adult mortality, suggesting that even if partially true, the third hypothesis cannot possibly tell the whole story. Because we use data on both sides of the border and because we are able to contrast not just self reported conditions but also a few selected biomarkers, we will be able to test all three hypothesis.

## DATA

Given the lack of a long series of prospective data following migrants to the US and back to Mexico, we propose the use of relatively comparable data sources in both sides of the border, namely: the National Health Interview Survey (NHIS) in the U.S., and the Mexican Health and Aging Study (MHAS) in Mexico. Both studies are nationally-representative and include comparable health measures (such as obesity, hypertension, diabetes, and cardiovascular disease, among others) and information on several relevant social and behavioral risk factors. In addition, to provide a benchmark for the assessment of our results based on self-reports, we include analyses with biomarkers included in the National Health Assessment and Nutrition Study (NHANES, 1999-2004 pooled samples) and in the Mexican National Health Survey (ENSA, 2001 sample), and on mortality from MHAS and the NHIS-NDI linked files (1989-1997 mortality follow-up).

The National Health Interview Survey (NHIS), fielded by the National Center for Health Statistics, Centers for Disease and Control since the late 1950s. Each (yearly) cross-section is a multi-stage, stratified sample of the U.S. population. We pooled the 2001-2005 waves for

reasons of statistical power and adjusted weights to reflect the pooling. In this case and given that the sampling frame for all years is similar we simply divided the weight by the number of waves, thus yielding a robust snap-shot of the U.S. population around the mid-point of the period (population-wise and not necessarily in health trajectories).

The Mexican Health and Aging Study (MHAS), a multi-stage stratified probability sample of the Mexican population aged 50 or older, is a prospective study first fielded in 2001. A follow-up survey was completed in 2003. The study made emphasis on migration of Mexicans to the U.S. over their lifetime, thus over-sampling states that have historically high emigration to the U.S. In the 2003 follow-up, a next-of-kin interview was completed for individuals who died in the two-year inter-wave period. This feature enables us to include mortality in Mexico as an outcome in this paper. To study mortality in the U.S., we use the mortality linkage of the NHIS with the National Death Index (NDI).

Given our interest in studying health selection in both U.S.-bound and return migration, it is necessary to put restrictions to the age of people in our study. As some migrants tend to circulate between Mexico and the U.S. during their prime labor years, (i.e. before age 45 see Riosmena 2005: Chapter 3), evaluating the health conditions of individuals in younger ages according to their migration status could confound the selectivity in migration with the association between the *timing* of migration and health in the absence of an event-history framework. Thus, we focus on the experience of individuals older than 50, which permits us to use the full MHAS sample. We also restrict the analysis to men, given that Mexico-U.S. migration in cohorts that are aged 50 and older was heavily male-dominated. These criteria limit the MHAS sample to about 5,000 individuals in the baseline, including about 300 deaths that occurred by the two-year follow-up. Given these same age-sex restrictions, the working sample



of native- and foreign-born Mexicans from NHIS is of 2,647 and 2,516 individuals respectively. From NHANES we use information from 1,586 native- and 1,483 foreign-born Mexicans, and from the NHIS-NDI linked file we use 2,800 individuals.

## RESEARCH HYPOTHESES

In this section we summarize the specific objectives of this research and their respective working hypotheses:

*Objective 1: To study patterns of self-reported measures of obesity, hypertension, diabetes, and cardiovascular disease among Mexicans living in the US compared to those living in Mexico.*

*H1a:* In the U.S., Mexican immigrants will be positively selected (will fare better) in terms of health outcomes with respect to Mexican non-migrants.

*H1b:* In Mexico, those with U.S. experience will be slightly positively selected in terms of health with respect to those with no migration experience to the U.S.

*Objective 2: To study the role of return migration in the association between self-reported measures of obesity, hypertension, diabetes, and cardiovascular disease, and the length of stay in the U.S.*

*H2a:* The association between duration in the U.S. and health outcomes will be negative for all self-reported measures.

*H2b:* Members of the same migration cohort who returned to Mexico will have worse health than those who remained in the U.S. This difference, however, will be primarily observed among Mexicans living in the US who have stayed longer; and in Mexico among those who have shorter duration since their return.

*Objective 3: To study the association between self-reported measures of obesity, hypertension, diabetes, and cardiovascular disease, and the age at return to Mexico from the U.S.*

*H3: Members of the same migration cohort who returned to Mexico will have worse health than those who remained in the U.S. This difference, however, will be primarily observed in individuals the longer the time elapsed since U.S. migration and the older they were when returning to Mexico.*

*Objective 4: To study the association between self-reported measures of obesity, hypertension, diabetes, and cardiovascular disease, and SES of three groups of Mexicans according to their past U.S. migration experience: those still residing in the U.S., those in Mexico with no previous migration experience, and those in Mexico who are return migrants.*

*H4a: The SES-health gradient will be flattest for Mexicans still in the U.S. when compared to non-migrants and return migrants observed in Mexico.*

*H4b: The SES-health gradient of return migrants will thus be flatter than that of non-migrants but steeper than that of migrants still in the U.S.*

*Objective 5: To reinforce findings from self reported conditions using biomarkers for diabetes and hypertension, and mortality levels experienced among adult Mexicans living in the US and those living in Mexico.*

*H5: Our hypotheses will be confirmed by the use of more objective measures of diabetes (e.g. glyc. Hemoglobin, plasma-glucose) and hypertension (systolic/diastolic blood pressure) from*

NHANES and the Mexican Survey of Nutrition and Health, and for mortality from the MHAS follow-up and the NHIS-NDI linked file.

## ANALYTICAL APPROACH

First, we use logistic regression to predict the probabilities that an individual self-reports obesity (defined as having a Body Mass Index  $> 30 \text{ kg/m}^2$ , based on self-reports), hypertension, diabetes, or heart disease, while controlling for factors such as age, education, income, home property status, gender, marital status, tobacco use, alcohol consumption, and region of residence. We stratify according to the country of residence, and include controls for duration since U.S. migration for those who live in the U.S., and for duration since return for those who returned to Mexico. In order to test our hypotheses that relate to the SES gradients, we will also include interactions between the duration variables and measures of socioeconomic status (years of education, income, and home property). The estimated gradients will then be compared between the two samples.

Second, we use logistic models to predict the probability of scoring high on biomarkers that are indicative of diabetes and hypertension, including the same controls described before. These models will elucidate the extent to which inferences from self-reports can be reproduced when using more objective indicators of health status. By the same token, we will use data from MHAS and modified logistic models to examine 2-year mortality among Mexicans living in Mexico while controlling for their U.S. migration experience. The NHIS-NDI data will be used to estimate hazard models for mortality among Mexicans living in the U.S. during the period that NHIS-NDI is available to us (1989-1994, with a 1989-1997 mortality follow-up).<sup>6</sup> To the extent

---

<sup>6</sup> Since NHIS survey years 1986 through 1988 did not include a variable for nativity or duration of residence in the United States, we will only use the 1989-1994 NHIS with 1989-1997 mortality follow-up.

that results are not idiosyncratic by type of health outcome used, we expect to find similar patterns of association in mortality as we do with other health outcomes.

Third, we aim to assess the determinants of differences in particular outcomes (self-reported condition, biomarker, or mortality) across four main groups: native- and foreign-born Mexicans living in the U.S. and those living in Mexico with and without U.S. migration experience. We use conventional decomposition analysis and study the extent to which differences between these groups are due to the *composition* of the populations by characteristics, or to the *effects* of those characteristics on the outcome of interest.

Fourth, we use standard propensity matching methods to address selectivity in our models. Straight comparison of the health gradient among the four groups mentioned, while informative, is not appropriate, because individuals who self-select into migrating to the U.S. may not be a random group with respect to our main outcome (health). Furthermore, those who *return* to Mexico after being in the U.S. may not be a random subset of either migrants or non-migrants. Thus, selectivity of migration needs to be taken into account when comparing health gradients among groups of old-adult migrants (or return migrants) now found in Mexico and the U.S. (Wong, Palloni and Soldo 2007). Moreover, given the aforementioned importance of duration of stay and since return, we try out several matching strategies using the MHAS and NHIS samples using duration since migration as well. That is, the treatment under consideration would not be migration status *per se* but migration status according to duration of stay/since return.

## REFERENCES

- Abraido-Lanza, A.F., B.P. Dohrenwend, D.S. Ng-Mak, and J.B. Turner. 1999. "The Latino mortality paradox: A test of the "salmon bias" and healthy migrant hypotheses." *American Journal Of Public Health* 89(10):1543-1548.
- Adler, N.E., T. Boyce, M.A. Chesney, S. Cohen, S. Folkman, R.L. Kahn, and S.L. Syme. 1994. "Socioeconomic-Status And Health - The Challenge Of The Gradient." *American Psychologist* 49(1):15-24.
- Antecol, H. and K. Bedard. 2006. "Unhealthy assimilation: Why do immigrants converge to American health status levels?" *DEMOGRAPHY* 43(2):337-360.
- Argesanau, S. 2007. "Are Migrants Healthier? A Review of Studies of Health among International Migrants in the United States." Presented at Migration and Cardiometabolic Risk: Obesity and Diabetes among Foreign-Born People in the United States, Emory University Global Health Institute. Atlanta, GA.
- Barcenas, C.H., A.V. Wilkinson, S.S. Strom, Y. Cao, K.C. Saunders, S. Mahabir, M.A. Hernandez-Valero, M.R. Forman, M.R. Spitz, and M.L. Bondy. 2007. "Birthplace, years of residence in the United States, and obesity among Mexican-American adults." *Obesity* 15(4):1043-1052.
- Ceballos, M. and A. Palloni. 2007. "Maternal and Infant Health of the Mexican-origin Population in the United States: The Effect of Acculturation, Duration, and Selection." Madison, Wisconsin.
- Cho, Y.T., W.P. Frisbie, and R.G. Rogers. 2004. "Nativity, duration of residence, and the health of Hispanic adults in the United States." *International Migration Review* 38(1):184-211.
- Dowd, J.B. and N. Goldman. 2006. "Do biomarkers of stress mediate the relation between socioeconomic status and health?" *Journal Of Epidemiology And Community Health* 60(7):633-639.
- Finch, B.K., R.A. Hummer, M. Reindl, and W.A. Vega. 2002. "Validity of self-rated health among Latino(a)s." *American Journal Of Epidemiology* 155(8):755-759.
- Jasso, G., D.S. Massey, M.R. Rosenzweig, and J.P. Smith. 2004. "Immigrant Health: Selectivity and Acculturation." in *Critical Perspectives on Racial and Ethnic Differences in Health in Late Life*, edited by N.B. Anderson, R.A. Bulatao, and B. Cohen. Washington, D.C.: National Academies Press.
- Jurkowski, J.M. and T.P. Johnson. 2005. "Acculturation and cardiovascular disease screening practices among Mexican Americans living in Chicago." *Ethnicity & Disease* 15(3):411-417.
- Markides, K.S. and J. Coreil. 1986. "The Health of Hispanics in the Southwestern United States - An Epidemiologic Paradox." *Public Health Reports* 101(3):253-265.
- Markides, K.S. and K. Eschbach. 2005. "Aging, migration, and mortality: Current status of research on the Hispanic paradox." *Journals Of Gerontology Series B-Psychological Sciences And Social Sciences* 60:68-75.
- McDonald, J.T. and S. Kennedy. 2004. "Insights into the 'healthy immigrant effect': health status and health service use of immigrants to Canada." *Social Science & Medicine* 59(8):1613-1627.
- . 2005. "Is migration to Canada associated with unhealthy weight gain? Overweight and obesity among Canada's immigrants." *Social Science & Medicine* 61(12):2469-2481.

- Palloni, A. and J.D. Morenoff. 2001. "Interpreting the paradoxical in the Hispanic paradox - Demographic and epidemiologic approaches." Pp. 140-174 in *Population Health And Aging*.
- Patel, K.V., K. Eschbach, L.A. Ray, and K.S. Markides. 2004. "Evaluation of mortality data for older Mexican Americans: Implications for the Hispanic paradox." *American Journal Of Epidemiology* 159(7):707-715.
- Población, C.N.d. 2007. "Situación Demográfica de México 2006." México.
- Razum, O. and D. Twardella. 2002. "Viewpoint: Time travel with Oliver Twist - Towards an explanation for a paradoxically low mortality among recent immigrants." *Tropical Medicine & International Health* 7(1):4-10.
- Riosmena, F. 2005. "Within, Between, and Beyond Space-Time: Three Essays on Latin America - US Migration Dynamics " Doctoral Dissertation, Graduate Group in Demography, University of Pennsylvania.
- Smith, K.V. and N. Goldman. 2007. "Socioeconomic Differences in Health Among Older Adults in Mexico." in *Princeton University. Office of Population Research Working Papers*. Princeton, NJ.
- Stern, M.P. and M. Wei. 1999. "Do Mexican Americans really have low rates of cardiovascular disease?" *Preventive Medicine* 29(6):S90-S95.
- Turra, C.M. and N. Goldman. 2007. "Socioeconomic Differences in Mortality Among U.S. Adults: Insights Into the Hispanic Paradox." *Journal of Gerontology: Social Sciences* 62B(3):S184-S192.
- Wong, R., A. Palloni, and B.J. Soldo. 2007. "Wealth in Middle and Old Age in Mexico: the Role of Previous Migration." *International Migration Review* 41(1):127-151.